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Title and author (if document is unnumbered)

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(Saints Versions)

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\* KZ 237 and KZ 238 are the same document (in this folder) with different document numbers. SGT 8/30/95  
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SANITIZED VERSION OF BI-WEEKLY PROGRESS REPORT  
FOR WEEK ENDING JUNE 21, 1946  
(Sanitized Version of CRD Document # KZ-237)

Compiled by  
S. G. Thornton  
Environmental Management Division  
OAK RIDGE K-25 SITE  
for the Health Studies Agreement

September 12, 1995

Oak Ridge K-25 Site  
Oak Ridge, Tennessee 37831-7314  
managed by  
LOCKHEED MARTIN ENERGY SYSTEMS, INC.  
for the U.S. DEPARTMENT OF ENERGY  
under Contract DE-AC05-84OR21400

This document has been approved for release  
to the public by:

*Roman W. Shelby*  
Technical Information Officer  
Oak Ridge K-25 Site

*9/15/95*  
Date

PLANT RECORDS  
CARBIDE AND CARBON CHEMICALS CORPORATION

PROCESS DIVISION

PROCESS DESIGN AND DEVELOPMENT DEPARTMENT

20986

Date: June 27, 1946

BI-WEEKLY PROGRESS REPORT FOR WEEK ENDING JUNE 21, 1946

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PROCESS ANALYSIS SECTION

PLANT RECORDS

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RESTRICTED DATA

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EARLY PROGRESS REPORT ENDING 1-22-65

G. A. Garrett

Classification changed to

Level and category

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I. Separation Performance Group

A. Installation of Spare Barrier Material

Calculations were carried out to show the change in top product concentration which would result from the installation of all spare barrier material. If all of the available material were installed, top product concentration would increase about 12.5%, at the current product rate.

B. Performance of Combined Plants at 90% Product Purity, II

An addendum to report 2.0.7, "Performance of Combined Plants at 90% Product Purity" has been issued. Results include a revision of the original inventory calculations which were found to be about 7% high. A table listing optimum pressures for each section of the K-25 enricher based on unrestricted minimum pressures is presented. It was found that by changing the minimum allowable pressure

the enriched X inventory was reduced by 7 kilograms.

C. Optimum 60 Cycle Pressures at 60% Product Purity

The production rate of 60% material was calculated using optimum restricted pressures for each section of both plants. (A table attached to the report lists the pressures). It was found that the amount of X obtained using optimum restricted pressures was 2.5% greater than the amount attained using maximum pressures in the K-25 enricher and restricted optimum pressures elsewhere. (The production rate using maximum pressures in the K-25 enricher was reported in a memorandum

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issued May 10, 1946. The enriched X inventory under optimum pressure conditions is about 9% less than that given in the March Prediction report.

## II. Engineering Data Group

### A. Diffusional Principles and Technical Data Book

The section on barrier theory involving separation factor, effect of pressures, permeability, etc. was distributed in a semi-final form among those in the department and Dr. Tenney's group for criticisms. This section will be revised by Dr. Tenney's group.

A section on systematic barrier nomenclature has been completed in which the various types of barriers and their relative qualities are listed. A rough copy of cascade equations has been prepared. This includes equations and theory on material balances, operating gradient, stripper and enricher productivity, total reflux gradient, ideal cascades and equilibrium time.

### B. Stage Properties

A study has been made for the operation of section K-306 at 60 cycles. The effect upon productivity was studied for two pressure conditions:

- (1) Maintaining the same pressure as at 120 cycles. ) at 60 cycles
- (2) Reducing the pressure at 60 cycles so that the inventory at 60 cycles is the same as that at 120 cycles.

In both cases the flow through the control valve goes from critical to non-critical, and the control valve position goes from about 56% closed to about 70% closed. The first method is slightly better from

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a productivity standpoint; however, the difference between the two is so small that the proper method should depend upon operational convenience.

A memorandum was issued entitled "Inventory of Sections K-309 and K-301 Under Variable Frequency Operation". This report presented curves showing the inventory of the two sections when operating at all combinations of frequencies between 45 and 65 cycles per second. At the estimated installed permeability and a tails pressure

### III. Mathematics Group

A report was completed which presents a method for calculating the loss in output resulting from a transient disturbance of the concentration from its normal steady state value. Such disturbances include temporary breaks in the cascade, interruption of feed, operation of a portion of the plant on inverse recycle, etc. The method is illustrated by application to an idealized plant resembling the K-25 plant.

### IV. Statistics Group

#### A. Scale Calibrations

Calibration data for scales 1, 2, and 3 of building 631 with 300, 1600, and 6000 pound weights indicate that the average of two measurements taken on each weight will be in error by less than 0.1%. A similar calibration of the K-131 Furnace Room and Feed Room scales on weights ranging from 25 to 6000 pounds indicated that weights up to 350 pounds can be measured to 1/8 of a pound and that

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additional readings will not increase the precision. The average of two measurements on weights in ranges of 375 to 6000 pounds will be in error less than 0.1%.

B. Surge Drum Pressures in the 600 Section

The surge drum pressures from May 7 to 12, 1946, and from May 21 to 30, 1946, were correlated with barometric pressures. No correlation was found between barometric pressures and the surge drum pressures.

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DEVELOPMENT SECTION

BI-WEEKLY PROGRESS REPORT ENDING 5/21/46

W. C. Moore

Compiled by J. A. Connors

I. Chemical Development Unit

A. Recovery of C-2144

During the past two weeks, a plant for the recovery of C-2144 has been constructed. The development work for the method of recovery of the oil has also been completed.

The plant has a capacity of at least 150 lbs. of oil/8 hour shift and can probably handle 250 lbs. in the same time.

Seven hundred and twenty-four pounds of C-2144 have been recovered during this period.

B. Recovery of MFL

Work has begun on the recovery of MFL. No difficulties have been experienced experimentally. The probable rate of recovery of this oil is 200-300 pounds/8 hour shift. A plant for recovery operations has been constructed.

C. Freon Recovery

One thousand and six additional pounds of freon 113 have been recovered from 1336 pounds of contaminated material.

D. Recovery of "T" from Carbon

A series of experiments are being run to determine the efficiency of burning pellet carbon in a muffle furnace. A tray filled to a depth of 1/2" with 6-8 mesh activated carbon containing approximately 40% "T" was roasted for 3 hours at a furnace temperature

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of 1100°F. Analysis of this sample showed 77.8% "T" (92%  $T_2O_8$ ) and 0.09% carbon. Further roasting for 6 hours at 1600°F changed the carbon content only 0.02% (to 0.07% carbon). A second experiment is being run using a bed depth of 1 and 1/4 inches. Recovery efficiency will also be determined.

F. Recovery of "T" from Filter Cake

A procedure for recovering "T" from the initial filter cake in operation of the 1303 has been developed. The method involves leaching with strong acids and neutralization with ammonium carbonate. All filter cake recovery has now been turned over to Cascade Services.

F. Corrosion of Pipes of Water Coolant System

Analyses from all water sampling taps in the K-25 water system have shown little or no corrosion of piping or equipment. Tests on the sanitary water system of K-27 are in progress as well as further experimental work on the K-25 system.

G. Plastics Shop

The following material has been dispensed during the past two weeks:

1. Sixty-two gaskets for the coded chemicals dept. 2-3/4" O.D. x 2" I.D. x 0.155" thickness (800 grams).
2. Thirty grams of MFP plug 1" diam. x 5/8" thickness to Lab. A.
3. Sheet material for 20-3/8" kerotest valve seats to Lab. D.
4. Sheet material for 20-3/8" kerotest valve seats and one sheet of 5" by 5" by 1/8" to the Valve Shop.
5. 1 piece of MFP 6" x 6" x 1/4" to Machine Shop for special equipment belonging to Coded Chemicals.
6. 1 piece of MFP 12" diam. x 0.038" thickness to Coded Chemicals for use on experimental equipment.

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7. 1 piece of MFP 4" by 4" by 1/8" to Dr. Amos of Lab. 9. for experimental purposes.
8. Specially treated soft gaskets of MFP swelled in trichloroethylene at 85°C for 7 hours have been made for Mr. Sylvan Cromer of Santa Fe, N. M.
9. Work is being done with the valve maintenance department regarding the use of MFP as a replacement for the rubber in the crane valves of 616 storage cans. A letter of recommendations has been written to this department.

#### H. Reaction of C-216 and Carbon

A unit has been assembled and experimental work has been started on the reaction of C-216 and carbon. The purpose of the investigation is to determine:

1. The effect of concentration of 216.
2. The effect of G-74 purging after 216 exposure.
3. The effect of using initial trap temperatures of 400-450°F before introduction of 216.

#### I. P<sub>2</sub>O<sub>5</sub> Trace Indicator Tubes

Control tests are continuing in 1408 with the P<sub>2</sub>O<sub>5</sub> trace indicators. So far no major differences in dew points have been reported between these indicators and the platinum plate unit.

P<sub>2</sub>O<sub>5</sub> tests are also being made in building 303-9 in the Process Area.

#### II. Seal Unit

##### A. Seal Inspection Program

The results of the daily seal inspection reports #53 to 59 inclusive are tabulated below:

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Type Seal	No. Inspected	Types of Failure			Replacement
		Failed Parts Not Evident	Melted Solder	Heavy Wear and Corrosion	
H-1	1	0	0	1	0
H-2	4	0	1	3	0
H-4	32	7	10	15	0
L-5	9	0	4	0	5
L-5E	6	0	0	2	3*
L-6	22	1	0	0	1
L-6-7	1	1	0	0	0
L-7	7	1	0	0	6*
Total	61	* From 306-1-2			

#### B. Operating Characteristics of L-5E Seals

Twelve L-5E type seals have been installed in 306-1-2 equipped with thermocouples. The seal changes were made at the same time the cell was down for converter changes. This cell will be used for determining the operating characteristics of L-5E type seals for comparison with L-7 type seals.

### III. Mechanical Development Unit

#### A. Valley Iron Pumps

##### 1. MFI Impregnated Amorphous - Carbon Seals

The graphite atmospheric seal that developed excessive leakage after a total of 3000 hours operation was replaced and the test continued on the MFI - amorphous carbon rings. The running time on these seals is now:

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G-74	-	93 hours 30 minutes
60-70% G-616	-	1407 hours 15 minutes
Total		1500 hours 45 minutes

The present leak rate is 0.125 std. cu. ft./hr at 0.50 psi seal differential pressure.

## 2. MFI Impregnated Graphite Seal

The pump containing MFI impregnated graphite was shut-down after having run for the following period of time:

G-74	-	77 hours 25 minutes
60-70% G-616	-	247 hours 20 minutes
Total		324 hours 45 minutes

The leak rate was 0.271 std. cu. ft./hr at 0.5 psi. The seals are being removed for examination and to replace them with graphite rings impregnated with a high melting MFI - P-10 mixture.

## 3. Impregnation of Carbon Seals

Three samples of graphite were impregnated with MFI/P-10 by out-gassing the rings and then submerging them in the mixture for 1 hour at 550°F. The weight gain was 12.4 plus or minus 0.4%. A set of rings were then impregnated for a running test on a Valley Iron Works Pump.

An attempt to impregnate Morganite resulted in a weight gain of only 0.3%.

## B. Orifice Testing

Three pilot plant orifices have been tested this past week. A total of 7 have been run to date.

The test stand is now being used by the converter group to test orifice plates for use in film flow tests on furnace stand B-14-S.

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C. W-Pumps

Two additional pumps were tested for pilot plant use and found satisfactory. The one piece construction brass cylinder pump was run on air and showed no signs of seizure. The inlet was throttled, bringing cylinder temperatures to 250°F. The compression ratios obtained with the inlets closed off were 6:1 for one cylinder (radial clearance - 0.004") and 8.8:1 for the other cylinder (radial clearance - 0.008").

This pump is now installed in the test loop and performance tests on C-616 are being made.

D. Instrumentation

The performance of a test in K-306-3 with automatic reset control was observed. Insufficient data were available for comparison to theoretical values of surge frequency and growth factor with the entire building on inverse recycle. The observed frequency of 11 cycles per hour with 66 stages on-stream compared favorably with a calculated value of 10 cycles per hour.

E. Lubrication

1. Test oil which had run three months in 10 Westinghouse fan motors of 302-5 was removed 6/10/46.

Two of the motors contained specially grooved bearings, but samples from all 10 motors contained considerable sediment. Laboratory results may indicate one of the three test oils used to be in better condition

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than the others. However, it appears unlikely that an oil will be found which will give better than the 3 months service presently being obtained with Duplex #1 in the present high lead content Westinghouse bearing.

2. A lubrication survey of the 1500 steam plant was completed and turned over to Maintenance. This schedule will be included in the schedule book which is being prepared for distribution.
3. The number of lubricants required under the code system was further consolidated by extending the use of the special code 2 PH (Regal A used at Power House) and eliminating the general code 2. The Code A calcium base cup grease was eliminated by specifying a calcium base ball and roller bearing grease for our B grease instead of the mixed base grease we had previously specified.
4. The recommendation previously made to remove the oil extensions to the sight cups on the fan motor bearings was approved by the Army through the Special Works Department.
5. General recommendations were prescribed to Maintenance on the lubrication of the 1401 section in a letter of 6/10/46. Coded lubricants were listed as equivalent to Navy Symbols for use when Navy Symbol stocks are

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depleted. Recommendations were made regarding the various machine parts encountered in the shop. A detailed schedule is being prepared which will list each piece of ship equipment and contain specific recommendations together with the frequency of application.

6. Analysis of oil samples taken before and after the test run in 306-1 and 305-11 without cooling the lube oil do not show that the oil was harmed by operating at the higher temperatures (174°F was reached). Preliminary investigations indicate that the power to be saved by operating with a lower viscosity oil is gained only at the expense of lowering the viscosity safety factor.

#### IV. Corrosion and Consumption Unit

##### A. "T" Content of Removed Seals

This program has been terminated because of the low absolute quantities of "T" found. As soon as current analyses are completed, an analysis of the data will be issued.

The program has revealed a research tool (variation of "T" content) that appears to be useful for seal research.

##### B. C-616 Consumption in Purge Cascade.

Consumption rate during the first seventeen days of the present dynamic test on cell #2 of 312-2 was calculated to be

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The total consumption for the 150 days this cell has been exposed to process gas during all tests is 974 grams of  $TF_6$ .

#### V Converters Unit

##### A. Psi Tests

A building separation performance test was run in building K-301-1 at a high side pressure. Samples were taken from cell 1 and 4 for assaying. This test is the first of a series of 14 tests to be run in the cascade.

#### VI. Conditioning Unit

##### A. Redesigning of Furnace B-14-S for Permeability Tests

The designs for piping alterations on B-14-S have been completed and the piping has been installed with the exception of the orifices which are being calibrated. Instrumentation plans have been completed and preliminary field work is in progress. The electrical plans have been completed and equipment procured. The rubber gaskets in the W-pump heads have been replaced with P-10, vacuum tested, and the pump installed.

##### B. Mobile Cold Trap

Construction of the mobile cold trap has been completed and the unit has been moved to the furnace area by stand D-11-T. The G-74 test run and conditioning will be done at this location. Corrected electrical, piping, and instrument drawings are being made.

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VII. Engineering Coordination Unit

A. Line Recorder Group

1. Mechanical Refrigeration

In an effort to reduce the refrigeration costs in the line recorder stations in the plant (\$7000/month), a study is being made to determine the feasibility of refrigerating the line recorder equipment by mechanical means. A similar study is also in progress on the possibility of cooling the product withdrawal cylinders by mechanical means. For line recorder refrigeration, the following action is being taken:

- a. A mechanical refrigeration test unit is being set up by the Instrument Division and tests will be made to determine the highest possible cold trap temperature.
- b. A study is being made of the economic feasibility of employing the refrigeration rooms around the cascade as a means of refrigeration. The possibility of using smaller York refrigeration machines (one per three stations) is also being investigated. There are nine or ten such machines classified as surplus.

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Product withdrawal tests have shown that:

	Maximum Withdrawal Rate	#/cylinder
(1) silver cylinder -30°C	60#/day	2.6
(2) aluminum " -30°C	60#/day	7.5
(3) monel " -30°C	40-50#/day	2-2.5

Since the plant requirements at present seem to be that a maximum of 50#/day can be withdrawn, -30°C seems to be acceptable for silver and aluminum cylinders. Colder temperatures would be needed for monel, but it seems unlikely at this time that any more monel cylinders will be used. The product withdrawal rate in aluminum cylinders is actually higher at -30°C than it is at -190°C (L-28). The reason for this phenomena has not yet been definitely determined.

B. Process Test and Special Problems Group

1. Water Failure Program

Tests simulating water failures have been completed in the K-306 Section and it was found that buildings in this section can be operated for at least several days with a water failure. The limitation is corrosion rate increase at elevated temperatures (Approximately 175°F); however, Operations will be in a position to make necessary decisions on running AC pumps vs. complete shut-down when the occasion presents itself.

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Recently tests were also conducted by Operations in the K-25 section on a simulated water failure. Results were slightly different from those in the K-K5 section. The water had to be turned on after two and one-half hours since the coolant temperature rose to 200°C. Lubricant temperature leveled off at 135°C during the test.

2. Tie Line Between K-27 to K-25 Section

A complicating factor has arisen in that the phase rotation at K-27 and K-25 are not the same. A tie-in may involve rewiring of transformers or motors or both. Investigation will proceed to determine practicability of tie-in with respect given to the above information.

3. Cathodic Protection of Electrical Feeders

In conjunction with the plan to use cathodic protection for protection against corrosion of electrical feeders in the plant, an investigation was made for determining which areas required immediate attention insofar as feeder losses are concerned. This information is being used by the Special Work Department in preparing a priority list for this type work.

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PROCESS DESIGN SECTION

Bi-Weekly Progress Report Ending June 22, 1946

A. A. Abbatiello

I. Air Cooling of K-27 Motors

When operating at tails pressure in K-27, it has been observed that the 2E, 4B, and 6B pump motors have been heating above their maximum recommended operating temperature. Although large quantities of outside air are delivered to the escape alley, very little of this air blows on the motors, because of the location of the inlets. This is not serious except in the case of the motors listed above which operate under the greatest loads.

To remedy this situation and prevent deterioration of the insulation on the motor windings a sheet metal duct and hood was designed to direct air into both ends of the motor. A test model was constructed and in a first trial reduced the motor temperature 50°F which is well below the recommended maximum.

II. Recovery of T from Carbon

A Simple Scotch Hearth Furnace has been recommended for use in recovering T from carbon. This type of furnace is used in lead smelting practice. It would consist essentially of a flat hearth heated from below by gas or electricity. The hearth would be covered by a hood closed on three sides. The material would be spread out on the hearth in thin layers and rabbled by hand rakes. It may be possible to make the operation continuous, feeding the carbon in at one of the closed ends by means of a hopper and removing the ash at the open end. This furnace has

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the advantage of simplicity and ease of construction but the disadvantage of requiring manual operation.

### III. High Quality Barrier Test for 302 Section

A test of the power necessary to operate a cell at tails pressure has given results approximately 6% above the calculated values. This means that one bank of four transformers could not supply three cells operating at \_\_\_\_\_ and one at \_\_\_\_\_ the expected conditions after the test of the high quality barrier. In order to overcome this, the power for the 15 cells will have to come from two transformer vaults.

This method of location of the cells was previously discarded because it was believed that the off-stream time would be too great. However, a more detailed study indicates that, by careful scheduling, installation of the converters in the 10 cells of K-302-4 and cells 1, 3, 5, 7, and 9 of K-302-5 will result in approximately the same off-stream time as installation in K-302-1 and K-302-2. In addition, the Electrical Section of the Plant Engineering Department now believes that nearly all the transformer vault changes can be made with the system 'hot', i.e., K-302-3 on-stream.

### IV. Product Cylinder

A design for a new flange for the product cylinder with built-in vacuum-tight valves was proposed by the Process Department. The design has been worked out and two experimental flanges are under construction, one of aluminum alloy (to reduce the tare weight) and one of nickel.

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- 3 -

This new flange will permit the removal of the product cylinder from the withdrawal manifold without allowing wet air to come into contact with the solid C-616. The valves are built into the head to prevent damage through mishandling. They are bellows-sealed, and have P-1C seats.

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REPORTS DISTRIBUTED FOR THE PERIOD ENDING JUNE 21, 1946

<u>Title</u>	<u>Author</u>	<u>Date</u>
G-616 - G-74 Mixing Patterns in Pipes After Processing Operations	B. Goluberg	June 11, 1946
Development and Calibration of a Continuous Visual Moisture Indicator for Plant Seal Exhaust Lines	R. P. Levey S. H. Smiley	May 15, 1946
Procedure for Making Operational Tests to Determine Life of L-5E Seals	Grabowski	June 14, 1946
Loss of Product in the Purge Gases	S. H. Smiley W. Angulo	May 28, 1946
Constancy of Concentration of U-235 in Normal Feed	W. H. Dotlefs C. Daniel	June 13, 1946
Operation of Sections K-309 and K-301 with A Pumps Operation at 60 Cycles and B Pumps at 45 Cycles per Second	V. W. Thompson	June 13, 1946
Inventory of Sections #1 and -1 under Variable Frequency Operation	V. W. Thompson	June 10, 1946
Relative Building Separation Efficiency Determined by Fractional Enrichment Curves for May	N. Heerema	June 14, 1946
Calibration of Scales	W. H. Dotlefs	June 20, 1946
The Effect on Product Purity of Differential Changes in Plant Constants	W. G. Siedenburger	June 11, 1946
Performance of Combined Plants at 90% Product Purity, II (Addendum to Report No. 2.8.7)	E. S. Johanson	June 19, 1946

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